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THE EXTENSION OF CONTROL IN VERBAL BEHAVIOR. FINAL REPORT.

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Seven 18- to 32-month-old children received from seven to 26 experimental sessions each between October 1966 and April 1967. A session lasted from 5 to 15 minutes and concerned control over the verbal responses of the children with token-operated reinforcement devices. In order to make the results of the experimental sessions meaningful, an attempt was made to describe the entering verbal repertoires of the children by observing vocalizations outside and within the sessions. The objectives of the experiment were different for children of different ages. The four children under 22 months of age at the beginning of the project were involved in the elicitation of echoic responses only. It was found that it was possible to elicit complex or multicomponent echoic responses by strengthening each of the components separately. For the three older children, 30 months of age or more, the goal was to expand the verbal capacity of the child beyond acquisition of mere arbitrary echoic responses to the acquisition of more meaningful utterances. The results were encouraging that such a goal is practicable. Teachers and parents can and should be trained in the strategies of eliciting vocal verbal responses from young children. (WD)

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THE EXTENSION OF CONTROL IN VERBAL BEHAVIOR

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THE EXTENSION OF CONTROL IN VERBAL BEHAVIOR

Introduction.

In work reported here an attempt was made to achieve experimental control over the acquisition of a vocal verbal repertoire by normal subjects between the ages of 18 and 32 months. A behavioral strategy for teaching vocal verbal responses was proposed, and this strategy was elaborated and refined through a series of replications with subjects from a variety of backgrounds. The findings of this study fall into these major categories: a) problems and solutions in the evaluation of an entering verbal repertoire; b) the maintenance of non-constrictive control over very young children's behavior; c) establishment and expansion of an echoic repertoire; and d) extension and refinement of stimulus control over vocal verbal responding.

Method.

Subjects.--Between October, 1966 and April, 1967, 103 five-to-fifteen minute experimental sessions were held at the Verbal Behavior Laboratory of the University of Rochester in Rochester, New York. These sessions were conducted by E with one S at a time, with minor exceptions. There were seven Ss in all; their ages at the first session and the number of sessions each participated in are given in Table 1. Ss clustered into two groups by age, and two by socioeconomic status. In the younger group, Alice, Chris, Jimmy, and Dwight were under two years; in the older group, Andre, Joey, and Julius were two and one-half or more. Alice and Chris were from upper middle class white families living in their own homes in "residential" neighborhoods of Rochester, New York; Andre, Jimmy, Joey, Julius, and Dwight were from lower class Negro families living in rented apartments or houses in dilapidated sections of Rochester's inner city. There were great differences among the Ss, even within the broad socioeconomic division given here. This division is based on reports of social workers and on E's visits to the homes of the Ss.

Sessions.--Sessions were conducted daily, Monday through Friday. Partly as a function of their tender age and the rigorous Rochester winter, all Ss missed days occasionally, and some missed blocks of days. All Ss except Alice were called for and delivered by E.

Apparatus.--Sessions took place in the Verbal Behavior Laboratory, in a 7' by 10' fluorescent lit, sound treated, carpeted experimental room observable through a one-way glass.

Table 1

Summary of Ss' participation in sessions

Subject	Age at Start	Number of Sessions	Period	Total Session Time
Alice	21 Mos.	26	7 Weeks	4 hrs.20 min.
Andre	30 Mos.	20	6 Weeks	3 hrs.20 min.
Jimmy	21 Mos.	7	2 Weeks	1 hr. 10 min.
Chris	19 Mos.	12	3 Weeks	1 hr. 32 min.
Joey	32 Mos.	14	4 Weeks	2 hrs.34 min.
Julius	31 Mos.	12	1 Week	1 hr. 17 min.
Dwight	17 Mos.	12	4 Weeks	2 hrs.00 min.

Behind the glass were located a TV camera and audio-video monitoring and recording equipment, and a technician-cameraman. In the experimental room were located a microphone, various token-operated reinforcement devices, and a token dispenser. With the three older Ss, a stool, a child-sized chair and table, small toys and colored pictures were also present. The token-operated reinforcement devices included a sink, a movie box, a twinkle box, and a candy dispenser; all were self-terminating, allowing the Ss to play with water for three seconds, watch a cartoon for eight seconds, see flashing lights for three seconds, or eat a piece of candy, respectively. Tokens were metal washers approximately 3/4" in diameter. Figures 1 and 2 represent two arrangements of the S-room. Figure 1 is more characteristic of room arrangement for the younger Ss, figure 2 for the older Ss.

Procedure.--The general procedure was as follows: E and S entered the experimental room together. After S's preliminary exploration, E introduced S to the token dispenser, provided a token and demonstrated the operation of one of the reinforcement devices. Thereafter, additional tokens were available to Ss, contingent upon emission of approximations to a series of behaviors, e.g. approaching E, attending to E, vocalizing, and echoing. Sessions then consisted of a set of recurring sequences, wherein S 1) approached E, 2) emitted an appropriate response or responses, 3) received a coin, 4) operated a reinforcement device, 5) re-approached E, etc. E's role included the presentation of model utterances or other stimuli between Steps 1 and 2, evaluation of S's response in Step 2, presentation of a token or other consequent event in Step 3, and participation with S in Step 4. E and S left the experimental room together at the end of a session. Details of this basic procedure are discussed below in the section on "Control" (pp.9 - 12). A series of sessions was organized about a "program" or strategy reflecting a proposed behavioral analysis, e.g. of the acquisition of an echoic repertoire. The strategy was modified on the basis of performance in sessions. Individual sessions followed the steps of pre-session plans which reflected a more fine-grained proposed behavioral analysis, e.g. of the acquisition of the response "wanna."

Recording Procedures.--Sessions were recorded in audio and video on the SONY ½" Videocorder. In addition, 35 mm. black and white photographs were taken at irregular intervals. From the tapes, transcriptions were made by E within 24 hours of session time. The transcriptions comprised a sequentially accurate narrative indicating phonetic shapes of E's and S's utterances, changes in direction of S's locomotion or visual attending, occurrences of vocalization and socially viable gestures, E's stance and facial kinesics, manipulation of stimulus items, and behavior associated with reinforcing events. Transcriptions were organized in terms of responses, conditions antecedent to responses, and events subsequent to responses

scale: ½''=1'

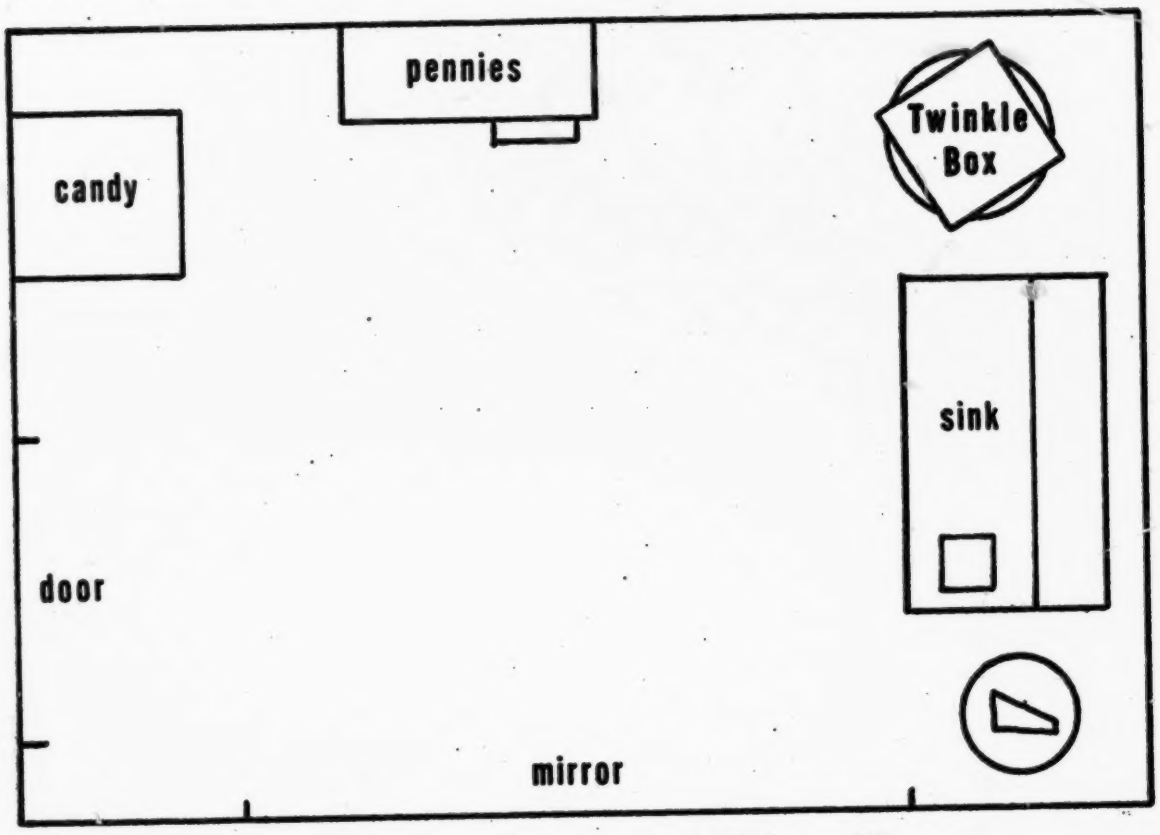

fig. 1 Set-up for Chris #3

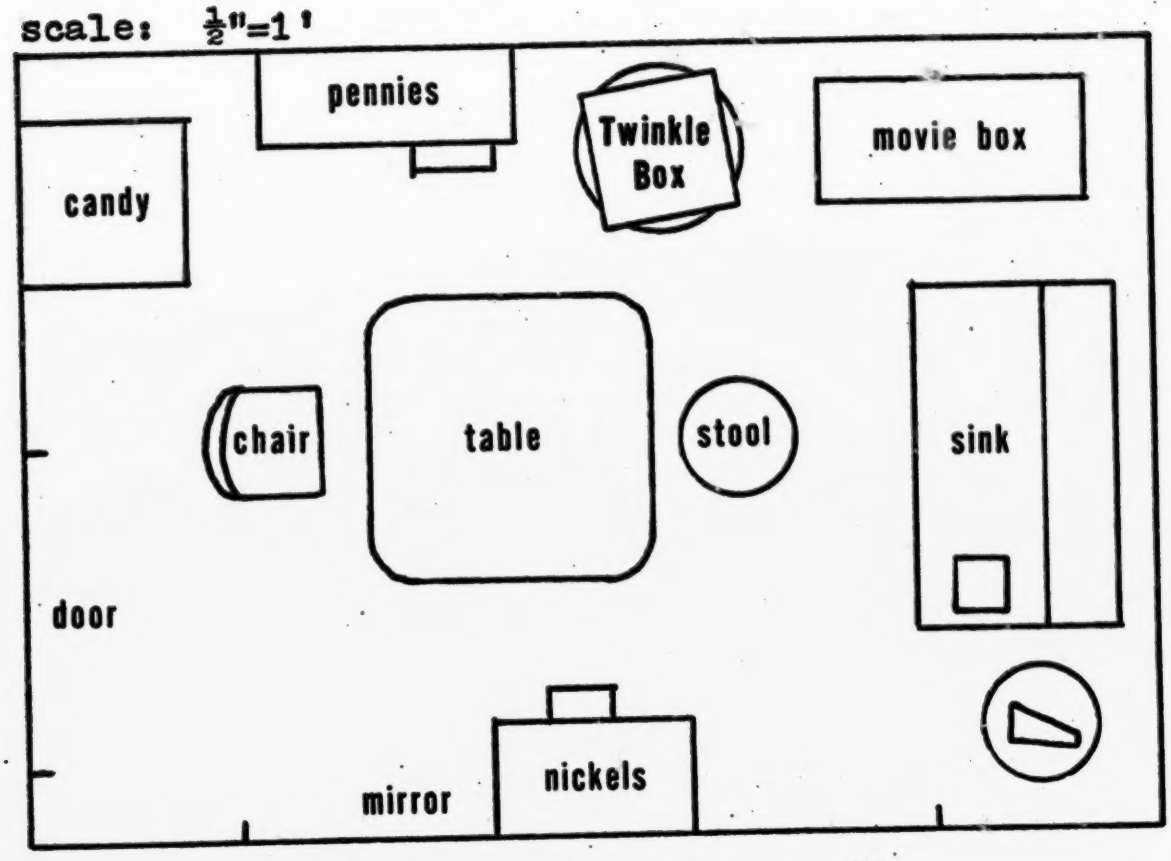

fig. 2 Set-up for Joey #9

reflecting the three-term contingency model of behavior proposed by Skinner (1953, pp. 108-110). Approximately 12 minutes were devoted to the detailed transcription of every one minute of session time.

Analysis.--Summary data from each session included the number of model utterances (Ms) offered by E, the number of non-model, "cue" utterances (Qs) by E, the number of vocal responses (Rs), by S, the number of token and other reinforcements (r's) presented to S and the disposition of these by S, i.e. the number of tokens deposited in a given reinforcement device. Since the size and shape of a "vocal verbal response," for example, was itself an important object of study, such quantitative data as "number of responses" were often less informative than details of the topography of a model or of a response, and of its functional relation to other within-session events. For purposes of inference, then, priority was given to "naturalistic" observations of behavior in context, rather than to manipulations of abstracted categories of doubtful validity.

Entering Repertoire.

The Problem.--The evaluation of the entering vocal verbal repertoire of the present Ss was necessarily of interest from the standpoint of inducing changes in that repertoire experimentally. However, serious problems in such initial evaluation were implied by the following set of conditions: 1) intact children of the ages dealt with here occupy some (presumably early) point in their sequential process of acquiring speech, i.e. they are neither clearly non-speakers nor speakers, 2) linguistic structural criteria (e.g. grammatical advancement) are questionably applied to the vocal output of organisms who are not yet securely linguistic, 3) it is unfeasible to monitor the entire behavioral history of an organism even over a two year lifetime, yet without such monitoring, the moment and context of acquisition of a response cannot be assigned reliably, 4) tests of language skill (e.g. intelligence subtests) presume test-taking behavior not widely present in 18- to 32-month-old children, especially sophisticated receptive language, 5) mothers' reports of their children's verbal behavior were, in the present case, diffuse and difficult to interpret.

Inferences from Outside Observation.--Description of Ss' entering verbal repertoires within this context involved two major sources of data: casual observation outside of sessions, and systematic observation within sessions. A careful analysis of outside-of-sessions observations suggested that all the Ss had interacted with adults who responded differentially to specifically echoic responding, that Ss made uneven improvement in linguistic proficiency, both within their echoic repertoire and between it and other linguistic repertoires, i.e. that their echoic responses did not necessarily reflect their best entering approximations to a given

set of phones. It also appeared that mothers interpreted idiosyncratic speech and non-spoken communication in a wholistic (cf. phonemic) manner, exploiting redundancies and knowledge of past events, and that all the mothers intervened in their children's language learning as sometimes effective, but never systematic, teachers.

Specific features that could be observed outside of sessions included the presence or absence of vocalization (all Ss vocalized), the phonetic and situational idiosyncracy of spoken responses, evidence of receptive language, accuracy and variety of echoic responses, and the occurrence of behaviors resembling those of children whose non-speaking is enforced by pathology, e.g. pulling people instead of directing them (here only observed in the three younger Ss). It was inferred that where such "non-speaker" behavior is strong, speaking behavior is relatively at the novice level. In general, the outside-sessions information made clear the need for multidimensional definitions of "speaking" and "listening."

Observation within Sessions.--Within-sessions, vocal behavior was divided for convenience into "on-line" (program-related, frequently "modeled," systematically reinforced) and "off-line" (casual, usually not modeled, haphazardly reinforced) vocalization. The rate of off-line vocalization was useful as a measure of talkativeness; in their first four sessions, Ss' vocalizations were distributed as shown in Table 2. Two types of adaptation to the laboratory situation emerged: 1) vocalization during the first session and a rapid increase in vocalization in the second session, with the rate remaining high, and 2) no vocalization in the first several sessions, with a rapid increase in vocalization occurring around the seventh session, remaining high thereafter.

It was clear that these two types of encounters by Ss with a new environment (initially vocal and initially silent) cut across the socioeconomic and age classifications mentioned earlier. On the other hand, both higher S-E-S subjects were immediately vocal, and three of the four lower S-E-S subjects were not. Differential effects of these initial rates of vocalization on E's behavior were examined and contrasted with the later school situation in which the disruptive behavior of "talking" is punished and only rigorously specified "talking" earns reward. In general, the rates of on-line and off-line vocalization indicated that as rate of on-line (programmed, systematically reinforced) responding increased over many sessions, rate of off-line (casual, unsystematically reinforced) responding also increased. It was observed that on-line and off-line vocalization quickly came under the control of different discriminative stimuli and were probably maintained by different sets of consequences.

Description of Entering Repertoire.--The following categories were useful, though not exhaustive, in characterizing

Table 2

Number of off-line vocalizations
by Ss in the first four sessions

Subject	1	2	3	4
Chris	9	25	17	15
Dwight	0	0	2	0
Jimmy	3	10*	17	55
Andre	28	51	57	18
Joey	0	1	1	1
Julius	0	0	0	0

*Six weeks intervened between Jimmy's sessions 2 and 3.

the Ss' entering vocal verbal behavior: 1) the presence (or absence) in Ss' vocalization of recurring phonetically identifiable sequences, 2) the prevalence (or non-prevalence) of English pitch-stress contours, 3) the occurrence (or non-occurrence) of gibberish, 4) high or low frequency of reduplicated syllables of the type [dIdI] or [mama], 5) occurrence (or non-occurrence) of syllable-final stop-consonant articulations in addition to glottal stop, 6) the length in syllables of the longest multisyllabic utterance (or non-utterance), 7) the level of audibility, 8) the possibility (or lack of possibility) of describing utterance parts as recombinable, 9) evidence (or lack of evidence) of control of vocal responses by stimuli not immediately present, i.e. "displaced" speech, 10a) the number of globally different English utterances emitted by any S in his first four sessions, 10b) the total of globally different English utterances emitted by any S over all his sessions. Table 3 shows the application of these categories to the present Ss' behavior.

In applying this summary description to Ss' entering repertoires, it was assumed that 1) Ss' repertoires were unlikely to be less elaborate on their last day of sessions than on their first day, 2) a child who has a vocal verbal repertoire will display it under some circumstances, and 3) circumstances in which vocalization is reinforced are among the more likely occasions for the emission of speech. The matrix of Table 3 reflected the complexities of intuitive judgments by parents and others about the speaking proficiency of very young children. In fact, the question, "Does Johnny talk yet?" is a multidimensional one. The categories presented here can increase the precision of the answers. Additional categories, especially in the area of kinesics, were suggested by observation of varying degrees of proficiency by Ss in presenting cues for address, e.g. turning to face E, along with their vocalizing.

A fundamental inference from this effort at description is that a child improves his speech on several fronts, rather than learning to talk and then going on to find out when to say what. While rate, topography and conditions can be discussed separately, each is a function of the others.

Control.

The Problem.--The exercise of control over the behavior of 18- to 32-month-old Ss here had two aspects, viz., 1) maintaining the gross behavior of remaining in the experimental situation for the duration of the sessions, and 2) establishing fine behaviors associated with particular teaching goals. Reducing the variability in Ss' behavior then created the conditions under which the influence of experimental operations on their verbal behavior could be investigated. In many experiments in psychology, control over Ss' behavior is tacitly assumed on the basis of a social context of cooperation, or is dependent upon verbal agreements, "Instructions,"

Table 3

Summary of Ss' vocal verbal repertoires

Dimensions	Subject						
	Dwight	Chris	Jimmy	Alice	Julius	Joey	Andre
Recurring phonetic sames	YES[a]	YES	YES	YES	YES	YES	YES
English pitch-stress	no	YES	YES	YES	YES	YES	YES
Gibberish	yes	yes	yes	yes	NO	NO	yes
Reduplicated syllables	yes	yes	yes	NO	NO	NO	NO
Shape of syllables	(c)v	cv(c)	cv(c)	cv(c)	CVC	CVC	CVC
Multisyllabic strings	(3)[b]	(5)[b]	(4)[b]3	4	5	5	6
Adequate audibility	no	YES	YES	YES	no	no	YES
Recombinable utterance parts	no	no	no	YES	YES	YES	YES
"Displaced" use of speech	no	no	no	no	no	YES	YES
English utterances, four sessions	0	1	4	7	8	1	66
English utterances, total	0	6	8	25	9	33	150

[a]Upper case entries reflect presumed advancement or proficiency on a continuum from non-speaker to speaker.

[b]Numbers in parentheses refer to number of syllables in non-utterance vocal responses.

or the like. With the present very young Ss, however, cooperativeness was irrelevant, and adequate receptive language skill for responding to complicated instruction was absent. Accordingly, procedures had to be worked out for training Ss in their role as participants in an experiment without relying on instruction.

The Basic Routine.--By the end of their first session, all Ss had emitted several sequences of approaching E, receiving a token, and going to "spend" the token in a reinforcement device. In two sessions, the receipt of a token had been made contingent upon Ss' sustaining eye contact with E for several seconds; this contingency was simply inserted into the above routine. In later sessions, receipt of tokens was contingent upon approximations to vocal responses of interest. In effect, E first established control over Ss' walking; i.e. when it occurred, and where. Thus, the opportunity to walk (e.g. from E to a reinforcement device) was contingent upon emitting low probability behaviors such as looking at E. Thus, the problem of incompatibility of very young Ss' highest probability behaviors with sustained teaching in a face-to-face situation was resolved. Other means of minimizing the problem of Ss' high mobility require some kind of constraint. However, mild (e.g. seating S on a high ledge), such constraint ultimately implies a loss of experimental control, since Ss' will emit operants for being released. With the relatively older Ss, however, it was possible to shape sitting in a chair for longer and longer periods, and to deliver tokens (and chances to walk) on an intermittent schedule. Younger Ss remained on virtually a continuous reinforcement schedule throughout.

Planned Variety.--When experiments with one S (Alice) had suggested the effectiveness of variety in the reinforcing procedures, an attempt was made to build variety into the sessions of a second S (Chris) on a systematic basis. Accordingly, the number, selection, and position of several reinforcement devices were varied daily, so that devices appeared intermittently. The results were seen in a change in the pattern of use of devices from initially heavy and exclusive use of one device and rapid subsequent avoidance of it, to initially less heavy, non-exclusive, and non-fading use of devices. Also, with the planned variety and unlike the earlier case, S entered the S-room eagerly, remained there for his entire session with no time-outs, for his entire experimental program of 12 sessions, and "spent" all earned tokens immediately. See Figures 3 and 4.

Reinforcement Devices.--The reinforcement devices discussed here were designed by Stanley M. Sapon in the course of a program of research into children's verbal behavior carried out under his direction at the University of Rochester since 1962. Important in the use of these mechanical devices was the fact that from Ss' point of view, tokens were delivered by an agent (a token dispenser) impervious to whining or

coaxing; likewise, the automatic termination of reinforcing events (e.g. the stopping of a cartoon movie) took the onus off E for ending the fun. The click of the token dispenser (produced by E's pressing a button) became a secondary reinforcer that was broadcast, prominent, and easily discriminated from other in-session events. The creation of a small token economy offset the effects of satiation with any single reinforcement device, and exploited choice-making as a high probability behavior. Fine-grained aspects of S's handling of tokens, e.g. elaborate hesitation, suggested that the opportunity to change the environment by dropping a token in a machine, rather than the particular operation of a given machine, was sustaining S's behavior. Similarly, although all Ss dropped many tokens in the Movie Box, no S used his tokens to watch a continuous film sequence, and several Ss ignored the film completely after the first few trials.

Establishment of an Echoic Repertoire.

The Strategy.--Having established the basic motor routine and the contingency of access to tokens upon looking at E, the next step in all cases was to bring S's vocal responding under E's control. Nearly all sessions with the four younger Ss were devoted to echoic responding. The overall strategy called for the establishment of an echoic repertoire of at least two responses (i.e. where M = model and R = response, $M^1 \rightarrow R^1$, $M^2 \rightarrow R^2$ constitutes an echoic repertoire), with the goal of combining these into one larger echoic response ($M^1M^2 \rightarrow R^1R^2$). This larger response was to be combined further with additional responses, and the usable verbal chain thus created was to be brought under other than echoic control. The significance in establishing an echoic repertoire lay in its efficiency in eliciting new vocal responses without requiring prolonged and relatively haphazard approximation procedures.

The Procedure.--This strategy was pursued by E's presenting a monosyllabic model (usually, "go") followed by the click of the token dispenser (hereafter, "reinforcement"). Where three such presentations occurred with no ensuing vocal response by S, the absence of an echoic repertoire of sufficient strength to have generalized to the new situation was inferred. Two separate shaping procedures ensued: in one, all vocal responses resembling a model of interest were reinforced; in the other, any vocal responses occurring with specified, gradually decreasing latencies from the model, were reinforced. These procedures occurred on a "timesharing" basis, i.e. in the same sessions, but at different moments within those sessions. The two procedures were then combined, so that reinforcement was contingent upon the emission of a vocal response resembling the model of interest and occurring immediately after that model. In this way, echoic repertoires (i.e. $M^1 \rightarrow R^1$, $M^2 \rightarrow R^2$) were established in all Ss. Improvements in technique and understanding of relevant variables

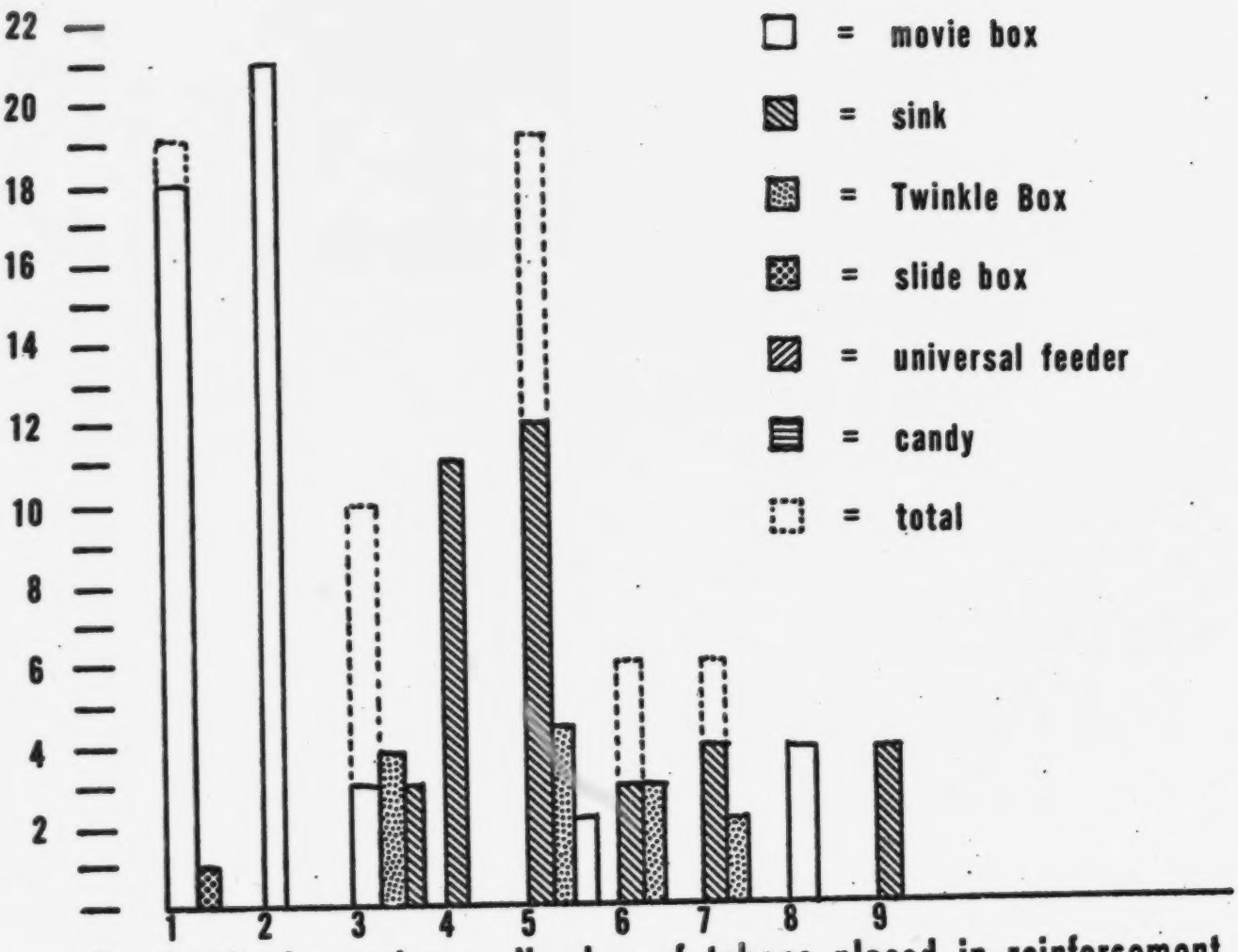

fig. 3 Alice's sessions. Number of tokens placed in reinforcement devices during sessions held in subject room.

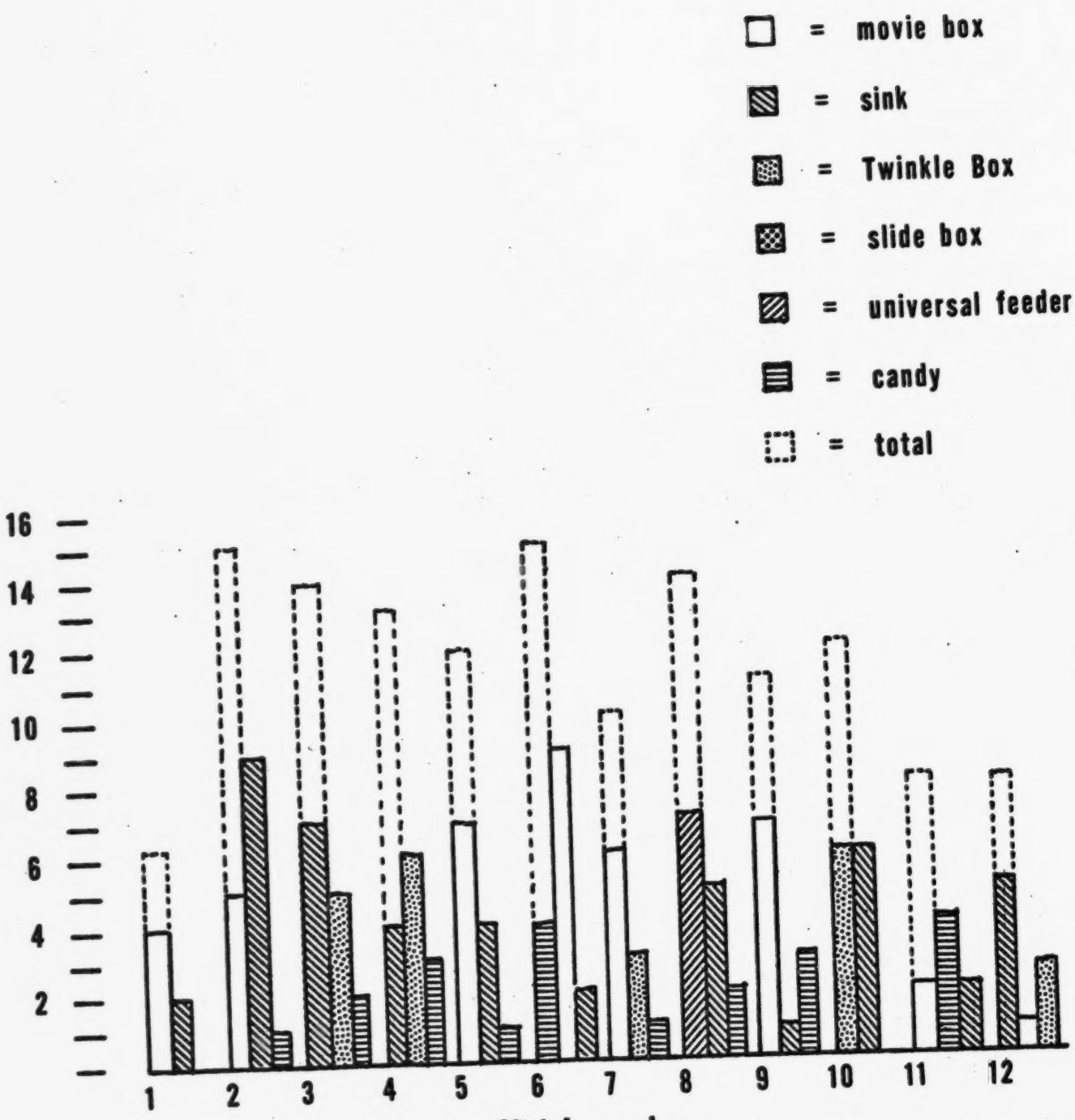

fig. 4 Chris' sessions.
Number of tokens placed in reinforcement devices during sessions held in subject room.

resulted in faster establishment of larger repertoires. For example, echoes of two different syllables were established by Alice's session 11, but echoes of three syllables were established by Jimmy's and Chris' session 7.

Among these improvements were the much earlier introduction of new model syllables (e.g. after only three or four accurate echoes of the previous model, instead of after 15 or 20), the presentation by E of only one type of model in any one session until several different echoic responses were established, the presentation of a small number of models in any one session, the careful timing of model presentation to coincide with moments when S's vocalization was, on the basis of established routine, most probable. These improvements must be viewed within the context of generally improved behavioral control represented in the discussion of "planned variety" above (p. 11).

Summary of Four Subjects' Programs.--The above procedure for establishing an echoic repertoire applied to the younger Ss, Alice, Jimmy, Chris, and Dwight. Since these Ss displayed a great variety of entering repertoires, the problems encountered with each S were to some extent unique. With Alice, unsuccessful attempts to combine the echoic responses [wa] and [nə] into the single bisyllabic response [wānə] 'wanna' were followed by the successful elicitation of the analogous combination of [mi] and [nə] into [minə]. A stage of strengthening echoic responses to reduplicative bisyllabic models of the type [mimi] was ancillary to this success. With Jimmy, differentiated echoic responses to models "go," "ah" and "me" were elicited. With Chris, "go," "eye," "ma," "see," "too" were echoed singly, then in sequences of the type $see^{M} \rightarrow see^{R}$, $me^{M} \rightarrow me^{R}$ and then in combination (see $me^{M} \rightarrow$ see me^{R}). With Dwight, attempts to combine monosyllables into multisyllabic responses were replaced by the strategy of eliciting and reinforcing multisyllabic responses first, and then attempting to refine the "segmental" features of the longer response. For example, a three-syllable approximation to "I wanna" proceeded through stages such as [awawa] [awaba] [awamə] or [awaⁱa] toward [aⁱwanə]. Dwight's program was complicated by the necessity to increase vocalizing from a rate of nearly zero; this was done by first reinforcing approximations to mouth opening.

Conclusions.--The following conclusions applied generally to all experiments in the establishment of an echoic repertoire: 1) it was possible to elicit complex or multicomponent (here, multisyllabic) vocal echoic responses by strengthening each of the components separately, 2) the phonetic shape of the components determined the likelihood of their being uttered in a combination approximating any given model (e.g. [wá'] plus [nʌ́] will not be combined to form [wá:nə], 3) the process of approximations to a multisyllable model was a complex one involving several coordinate approximations, 4) a history

very high strength responding to only monosyllabic models with monosyllabic responses was detrimental to multisyllable echoing, 5) introduction of multisyllabic models before such high strength monosyllabic responding was acquired was ancillary to multisyllabic echoing, 6) reduplicative echoic responses (e.g. [mimi] had a higher probability than other bisyllabic responses), 7) vocal echoic responses learned under one set of conditions could be elicited by partial replication of those conditions--in particular, the site at which a response was taught could exert powerful control over the response, 8) a high-strength vocal response will be emitted under novel conditions, 9) under certain conditions, responses learned separately will be uttered in close sequential proximity without previous modeling of the sequence, (e.g. where one response is prepotent from previously applied experimental contingencies and another response is favored by current experimental contingencies).

Extension of Stimulus Control.

The Strategy.--Shaping the topography of a vocal response was considered as a distinct behavioral task from bringing that response under the appropriate control of a variety of eliciting stimuli and characteristic consequences. When echoic responding was present, response topographies were under E's control, but responses were arbitrary from S's point of view, and from the speech community's point of view. With the three older Ss, E undertook to change echoic responses from relative arbitrariness to the status of viable utterances. Accordingly, vocal responses were reinforced in the presence of increasing numbers of eliciting stimuli, both verbal and non-verbal. Further, the reinforcing events were made increasingly appropriate to the particular response of interest.

The Procedure.--When purely echoic responding had been established, the stimulus "say" was introduced preceding model utterances. The presence of "say...," therefore, became discriminative for echoing. Visual stimuli (pictures, toys) were shown to Ss while models were presented, e.g. the numeral one was shown when S echoed "I see one," and the numeral two with "I see two." Then a non-model (or "cue") utterance was presented quietly prior to the louder model, e.g. "What do you see?" (quietly)..."say 'I see two'" (loudly). Over several sessions, the cue was increased in loudness and the model decreased in loudness. Ultimately, the cue was responded to correctly without the model, i.e. a question was answered. Such non-echoic responses were reinforced, in Andre's case, criterion responses to "What do you see?" increased from zero in session 5 (when the cue was introduced), to three in session 6, to ten in session 7. Additional utterances with accompanying pictures, e.g. "I see a car" were similarly established as non-echoic "answers," this was accomplished in three or four trials within a single session. A second set

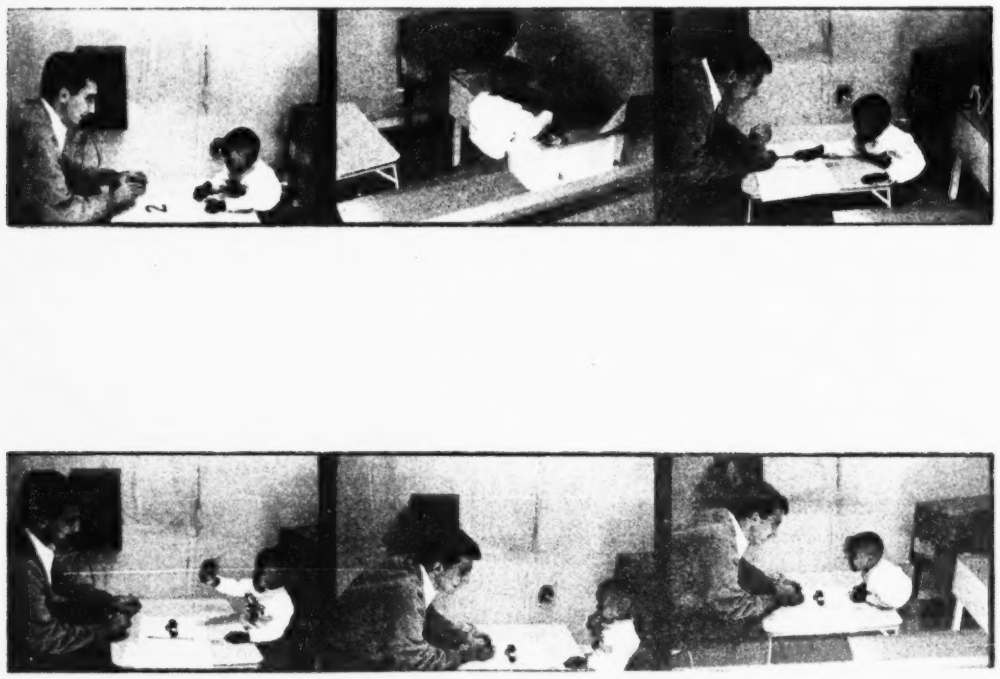

Plate 1. Part of an experimental session with Andre, 30 months. In frame 1 (top left) the utterance being elicited is 'I see two'; in frames 4-6 (bottom row) 'I see a car' is being elicited.

of utterances involving the same pictures was modeled for S, e.g. "I wanna (car, man)." Criterion answers to the new cue, "What do you want?" were then obtained without fading in the cue or fading out the model. Differential consequences were supplied; "I see a (car)" was followed by a token, but "I wanna (car)" was followed by a gift of the item mentioned.

Brief Summary of Three Subjects' Programs.--The three older Ss' programs followed the outline presented in the previous section. In addition, in Andre's program, a second experimenter, also male, was trained by viewing video tapes of earlier sessions and by discussion with the first E to conduct session 15. The second E followed a pre-session plan prepared by the first E. The rate and topography of Ss' responses with E_2 were virtually indistinguishable from those obtained with E_1. There was no noticeable warm-up or adaptation period. The replacement of E_1 by E_2 represented a large magnitude of extension of stimulus control over Ss' vocal responding, and supported the replicability of the experimental procedures.

With Joey and Julius, different utterances were used, but with the same approach, e.g. "It's a_____" for "I see a_____," and "Gimme the_____" for "I wanna_____." Also, a game was used to provide natural consequences for Ss' vocal responses that met topographical criteria, and that were appropriate to the vocal cue stimulus. E covered his eyes and asked, "What should I take?" Ss responded by picking up an item from an array of toys, but E did not actually take the item until S said, initially, "the horse" (or whatever), and subsequently, "Take the horse," etc. The game was reversed with E asking, "What do you want?" or "What should I give you?" and S responding with "Gimme the_____." Eventually, seven or eight such exchanges were emitted prior to token reinforcement, and a session consisted of four or five sets of exchanges. For two sessions, Joey and Julius underwent training together, in which each used the above responses to control the giving or taking behavior of the other. Again, the replacement of E by another S represented an extension of stimulus control over S's vocal responding.

Conclusions.

The following conclusions were suggested by work with the three older subjects: 1) among very shy Ss, reinforcement of motor exploration of a new environment tends to increase the probability of early vocalization within that environment; 2) a simple combinatory model will not account for the stringing together of multisyllabic vocal responses into still longer echoic responses, since accurate combined echoes presuppose a series of approximations to properties that are unique to the combination, e.g. a unitary pitch-stress contour; 3) the tendency for the final portions of longer utterances to be echoed accurately and to resist breaking down is related not only to limitations of

memory, but to a) the likelihood that utterance finals receive immediate reinforcement, and b) the difficulty of reinforcing early portions of utterances without disrupting the utterance; 4) bringing parts of unitary utterances under the discriminative control of different kinds of stimuli, e.g. verbal and visual, is a viable strategy for eliciting utterances under novel stimulus conditions, including the special case of novel or recombined cue utterances; 5) some instances of "understanding new utterances" can be predicted on the basis of the reinforcement history of responses emitted previously in the presence of other, similar utterances.

General Conclusions and Recommendations.

Experimental investigation of very young (18- to 32-month-old) Ss' acquisition of vocal verbal responses presupposes the achievement of control over all high probability behaviors of the Ss.

When such control is achieved, the acquisition of vocal verbal responses by Ss 18-32 months can be directed in a replicable fashion during periods of several minutes' interaction occurring over several days or weeks.

Notwithstanding great differences in entering repertoire, e.g. "shyness," and socioeconomic history, intact Ss will vocalize readily in a new environment that provides uniquely reinforcing consequences for speaking or vocalizing.

The sooner and more frequently very young Ss entering a new situation vocalize, the more opportunities teaching agents in that environment have to modify and refine that vocalization.

Teachers (including parents) can and should be trained in the strategies of eliciting vocal verbal responses for purposes of extending the flexible interaction of S's speech and his environment. Specialized reinforcement devices are helpful but not necessary to this effort.

REFERENCE

Skinner, B. F. Science and Human Behavior. New York: The MacMillan Company, 1953.